INSIDER

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Secretary Bodman Visits Ames Lab

Science updates and all-hands meeting highlight Secretary's visit

"It is very difficult for me to imagine anyone anywhere who is better qualified to serve our nation as Secretary of Energy than Samuel Bodman," said Ames Laboratory Director Tom Barton as he introduced the Secretary at the all-hands meeting in the Spedding auditorium, Friday, June 3. "Leading our nation to a secure energy future is about as daunting a task as I can imagine, frankly, but we are indeed fortunate that someone with such incredibly impressive and appropriate credentials as has Secretary Bodman …"

Barton never got to complete that accolade as the auditorium went pitch black. The momentary "lights out" came about as Kerry Gibson, the photographer for the day, unfortunately bumped into the light switch while trying to make way for a latecomer who was looking for a seat.

Without missing a beat, Barton eased the moment, drawing laughter from the audience as he calmly announced, "Yet another energy crisis!"

Laughter turned to applause as Barton heartily welcomed Secretary Bodman to the Lab. Coming to the podium, the Secretary thanked members of the audience for turning out in such great numbers on a Friday afternoon in the "almost summertime."

Showing his sense of humor, the Secretary said, "I'm about four months into the job, which means that I'm probably armed and dangerous because I'm starting to think that I know what I'm doing. I am devoting much of my time in the early days of my job tenure to traveling the country and getting to know the people who work for, with and around the Department of Energy operations; that's why I'm here in Ames. I want you to know that I'm particularly pleased to be here," he added, noting that he was born and raised in the neighboring state of Illinois.

Secretary Bodman explained that he's an engineer and brings that perspective to his job with the Department of Energy. "The national laboratories, like this one, have a special meaning to me," he said. *continued on page 4*

Secretary of Energy Samuel Bodman (left) chats with Director Tom Barton during the Secretary's Ames Lab visit, June 3.

Lab Receives $1.6 Million to Study Complex Hydrides

Hydrogen fuel storage research part of Hydrogen Fuel Initiative funding

Hydrogen is being touted as the fuel of the future, a clean-burning, renewable and inexpensive replacement for petroleum. But a major stumbling block for hydrogen-powered vehicles is figuring out a way to carry enough hydrogen onboard to travel even moderate distances between refueling stops.

A group of Ames Laboratory researchers will be investigating a possible solution to that problem thanks to $1.6 million in funding announced recently by DOE Secretary Samuel Bodman as part of a $64 Million Hydrogen Fuel Initiative. Funding for the project will be spread over three years.

"With compressed hydrogen gas, you simply can't carry a tank big enough to travel very far," Ames Lab senior scientist Vitalij Pecharsky says. "The answer is a hydrogen-rich, solid fuel that mimicks the hydrogen content of methane, where four hydrogen atoms encapsulate a single carbon atom."

Unlocking the Hydrogen

So why not just use methane? According to Pecharsky, methane and similar hydrocarbon compounds have covalent bonds that keep the hydrogen atoms tightly "locked" in place. The energy required to break those bonds is very high compared to the energy you'd get from the hydrogen produced. Also, methane and other hydrocarbons that come from oil are not renewable. The ideal solution would be a hydrogen-rich solid material that gives up its hydrogen atoms easily, through moderate heating or by other means. These materials could also be "recharged" – absorbing "new" hydrogen atoms during refueling from a pressurized hydrogen gas source.

That's why Pecharsky and fellow Ames Lab scientists Marek Pruski, Victor Lin and Scott Chumbley are looking at some novel materials – light-metal alanates, borohydrides, amides, imides, and their derivatives – that have a total hydrogen content exceeding 10 percent by weight.

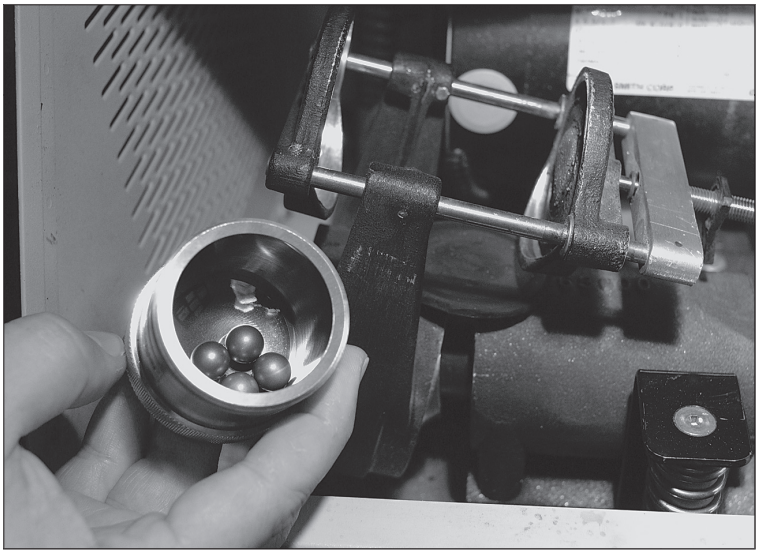
Shaking things up

A key component in the research project is solvent-free mechanochemical processing, a technique Ames Laboratory researchers had shown back in 2002 to work well when applied to complex hydrides. The process uses variable energy milling to modify both the structure and properties of hydrides, and potentially, to make them easily rechargeable with hydrogen. Materials to be processed are placed in a hardened steel vial along with steel balls. The vial is vigorously shaken and mechanical energy transferred into the system alters the crystallinity of the solids and provides mass transfer, eventually breaking down the solids and releasing hydrogen, or combining the materials and hydrogen gas into new compounds.

"Processing these materials without the use of solvents is important," Pecharsky says, "because once a material is dissolved, its structure fundamentally changes. Creating these complex hydride compounds in solid state will allow us to look at the molecular structure to see if there are ways to more easily get the hydrogen back out of these systems."

Keeping it "small"

Another ingredient the group will use is called nanostructuring. Ames Lab chemist Victor Lin has developed a way of using the nanoscale pores in a self-assembling polymer as "molds" to precisely control the size of the material particles going into the milling process. Smaller particles have higher surface energies, and surface energy may be a decisive factor in shifting thermodynamic equilibrium. Lowering the size of particles to a few nanometers also reduces the distances over which the mass transport takes place, thus improving the kinetics – the rates of the reactions – of complex hydride-hydrogen systems.



The research will rely on solid-state mechanochemical processing to form hydrogen-rich compounds. Materials to be processed are placed in the steel vial of a ball mill, like the one pictured above, along with metal balls. The shaking action of the mill alters the crystal structure of the materials so that they combine in the solid state without the need for solvents.

Synthesizing various combinations and sizes of materials will provide samples to be studied and characterized using a variety of high-tech methods. Ames Lab metallurgist Scott Chumbley hopes that scanning and transmission electron microscopy will give researchers a close-up look at the structure of the processed materials. The team will also rely on the expertise of Ames Lab senior scientist Marek Pruski in using solid-state nuclear magnetic resonance. Earlier studies performed by Pruski's group proved that NMR is uniquely suited for the studies of complex phases resulting from the milling process. Coupled with X-ray powder diffraction, and other traditional materials characterization techniques, researchers hope to gain a fundamental understanding of the relationships between the chemical composition, bonding, structure, microstructure, properties and performance of these materials.

"We'll look at the rates of absorption and desorption of hydrogen as well as the cycling properties of these materials at various temperatures and pressures," Pecharsky says. "Furthermore, we plan to modify these nanoparticles with titanium and other transition metal catalysts and perform a full array of characterization and hydrogenation-dehydrogenation property tests on these metal-doped nanostructured hydrides."

Predicting outcomes

Parallel with the materials' characterization, the group will work with physicist Purusottam Jena of Virginia Commonwealth University to develop first-principle theoretical models based on the experimental data. Those models will then be used to predict outcomes of further experiments. The predictions and actual results will be compared to see if the theory holds or needs further modification. Ultimately, the theoretical model will be used to help steer research toward the most promising compounds. ■

~ Kerry Gibson

Covey Named FLC Deputy Coordinator

Deb Covey, manager of Industrial Outreach and Technology Administration, has been named deputy coordinator of the Federal Laboratory Consortium Mid-Continent Region. She served as an FLC Executive Board member at large in 2002-2004 and on various committees.

As deputy coordinator, Covey says she envisions increasing laboratory, university, business, and state and local participation in the educational and technology transfer activities of both the Mid-Continent Region and the National FLC. The Mid-Continent region includes: Iowa, Kansas, Arkansas, Texas, Oklahoma, Missouri, Nebraska, South Dakota, North Dakota, Montana, Wyoming, Utah, Colorado and New Mexico.

"Exciting technologies are coming out of the federal laboratories, from medical devices to new techniques for fighting fires to new agricultural products," Covey says. "I'm looking forward to working with the Mid-Continent region's federal laboratories to help spread the word that the laboratories are national resources and with their technology-transfer personnel to assure that training and the management tools needed to succeed in our profession are readily available."

Deb Covey

She would also like to see the region provide seed funding for applied research activities that engage the technologies and expertise inherent in the region's laboratories. ■

New Employees

John Fielden, postdoctoral fellow (Paul Koegerler)
Ming-Hui Ge, postdoctoral fellow (John Corbett)
Xuefeng Guo, postdoctoral fellow (Dan Shechtman)
Yali Li, postdoctoral fellow (Matt Kramer)
Michael McGuigan, health physics technician (Tom Wessels)
Debbie Pickard, assistant chief accountant (Jean Boot)
Robert Vincent, visiting scientist (Ferdinando Borsa)
Nan Wang, postdoctoral fellow (Rohit Trivedi)
Xuezheng Wei, postdoctoral fellow (Bruce Cook)
Jiaqiang Yan, postdoctoral fellow (Robert McQueeney)

Fickle Finger of Fate Points to Gibson

It was one of those moments that won't soon be forgotten – Kerry Gibson leaning against the light switch and plunging the Spedding auditorium into darkness just as Director Tom Barton was introducing Secretary Bodman at the all-hands meeting, June 3.

As fate would have it, Gibson, communications specialist in Public Affairs, was doubling as photographer for the Secretary's visit – a good deed that culminated with a good deal of ribbing from friends and coworkers. In fact, so impressive was the blunder that Gibson actually earned a place in Ames Lab history as the first person outside of the Materials and Engineering Physics Program to receive the Fickle Finger of Fate award.

Trevor Riedemann, MEP assistant scientist, presented the Triple F to Gibson in a not-too-solemn ceremony on the Monday following the Secretary's visit. Riedemann notes that the Triple F is a traveling award, sometimes making its way to two or three individuals in the same day, depending on the superiority of their ability to bungle something up. Gibson's unanimous selection as the first non-program employee to receive the Fickle Finger of Fate is testimony to his high level of skill in that area. ■

~ Saren Johnston

Kerry Gibson modestly accepts the traveling Fickle Finger of Fate Award from Trevor Riedemann.

Triple F

Much like Gibson's accidental "lights out," the Fickle Finger of Fate was the result of someone trying to do a good deed. Lanny Lincoln, senior research technician, had made a lead-free solder casting for senior metallurgist Iver Anderson and was trying to save the crucible. "I put the crucible on its side and used a laboratory heat gun to heat the remaining melt," says Lincoln, adding that he pushed the crucible aside when the melt got hot enough and started running out. The melt solidified into the distinctive form that became the Fickle Finger of Fate.

Secretary Bodman Visit *continued from page 1*

"The laboratories have been enormously productive organizations in helping to maintain our nation's leadership in science and technology. This lab is one of the smaller labs in the group, but that does not reflect on the preeminence of the work that is done here. The work of materials technology I was prepared to believe before I got here was quite extraordinary, and that was reinforced once I arrived."

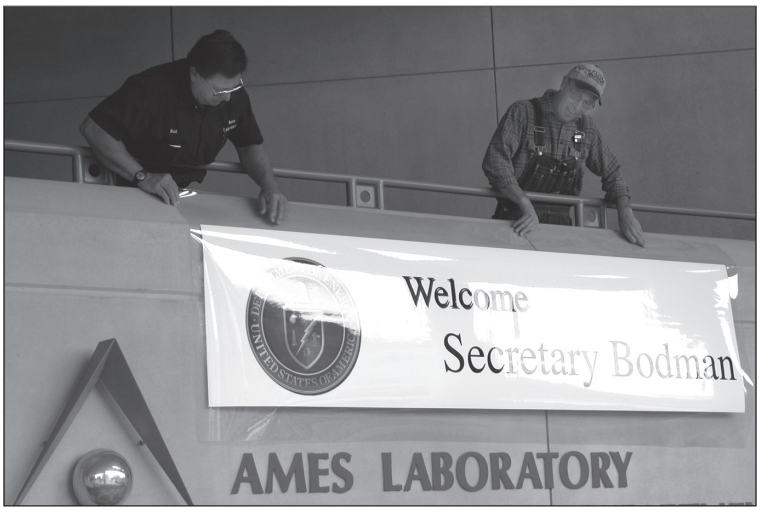
The Secretary expressed his admiration for how well the Lab works on an interdisciplinary basis. "You seem to have perfected that art," he said, praising the Lab's unique ability to integrate students, both graduate and undergraduate, into its research endeavors. Commenting on the fact that student employees account for some 20 percent of the Lab's workforce and that thousands of them have received their degrees while working here, the Secretary said, "That's really extraordinary. It's quite amazing and something to be treasured – something for you to focus on."

Offering Ed Yeung's multiplexed capillary electrophoresis technology as an example, Secretary Bodman encouraged the Lab to continue its interest in working on technologies and products that could have commercial possibilities. He emphasized that the partnerships that include government funding in support of science research, the potential commercial partners in these endeavors, research universities, and venture capitalists have, in his opinion, helped create what we call today the American economy. "Without that process, we wouldn't have the economy we have today, by any means," he said. "It has been something that the Ames Laboratory seems to have a real focus on in its own way, and I would continue to encourage you to realize and treasure what you have here because it really is something quite special."

Concluding his remarks, Secretary Bodman said, "I'm very pleased and honored to have this job. I am very committed to seeing to it that this department manages its affairs better than it has in the past. We have a lot of very wonderful people working for this department, and I'm extremely pleased with the reception I've gotten. This is the first time that a person has taken on the job as Secretary of Energy who is burdened by some knowledge of energy," he added, drawing appreciative laughter from the audience. "With that, frankly, come expectations that I'm not sure can be met. But I want you to know that we're going to work very hard on it. Hopefully you'll look at me as someone who has some understanding of what to do and how to do it. I've got this job, and I'll be very serious about it," he promised, adding, "I'll count on your help as we go forward." ■

~ Saren Johnston

Flanked by security personnel and Lab officials, Scretary Bodman begins his Ames Laboratory tour accompanied by Director Tom Barton and Alan Goldman, division director of Science and Technology.



Bud Ahrens, plant services supervisor, (left) and Mike Dotzler, facilities mechanic, get ready to hang the welcome sign in preparation for Secretary Bodman's visit.

Senior physicist Marshall Luban discusses Ames Lab's efforts to understand the basic science of the magnetic properties of synthesized magnetic molecules, compounds that may one day lead to applications that include novel designs for magnetic memory, fast switching devices, and quantum computing.

Secretary Bodman makes a point as he speaks to a standing-room-only crowd at the all-hands meeting.

Science Highlights Secretary's Visit

Short tours of cutting-edge research projects underway at the Lab were a major part of the Secretary's visit, June 3. The Secretary listened to numerous presentations and chatted with scientists and students during his approximately two-hour stopover at Ames Lab.

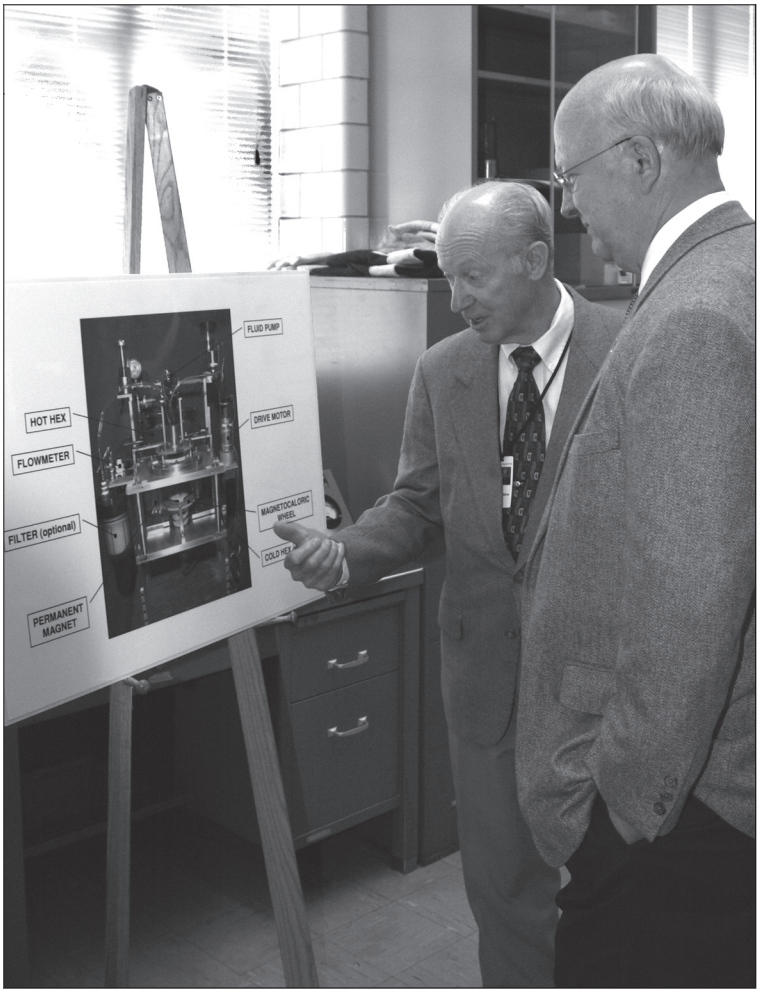
The Secretary's tour began in TASF with a presentation on photonic bandgap crystals by Kai-Ming Ho, senior physicist; Kristen Constant, associate; Chang-Hwan Kim, postdoctoral fellow; and Jae-Hwang Lee, graduate assistant. Their talk was followed by a presentation on left-handed materials by Thomas Koschny, research associate. Next, it was on to Spedding Hall, where the Secretary learned more about magnetic molecules from Marshall Luban, senior physicist, and Paul Koegerler, associate scientist. Commenting later on the Secretary's obvious interest in their presentation, Koegerler said, "He asked really good questions, which shows he cares."

Following Luban and Koegeler's presentation, the Secretary crossed the hall to the lab of Surya Mallapragada, program director of Materials Chemistry and Biomolecular Materials, who, along with graduate student Mike Determan, introduced the Secretary to the research on self-assembling polymers. Klaus Schmidt-Rohr, associate, followed their presentation with one on nuclear magnetic resonance studies of polymer fuel-cell membranes.

Following a break for the "all-hands" meeting with employees (see related story), the Secretary was back for more of his research tour, stopping first to hear about magnetic refrigeration from Karl Gschneidner, senior metallurgist, and Vitalij Pecharsky, senior scientist. Concluding the Secretary's tour stops was a presentation by Ed Yeung, program director of Chemical and Biological Sciences, and Brian Trewyn, graduate assistant, on associate Victor Lin's research efforts to develop novel synthetic methods for the preparation of a series of multi-functionalized mesoporous silica nanoparticle materials.

Throughout the science tour stops, the Secretary showed great interest in the researchers and their work and expressed how happy he was to be visiting the Laboratory. ■

~ Steve Karsjen



Senior metallurgist Karl Gschneidner visits with Secretary Bodman about magnetic refrigeration.

Surya Mallapragada, Materials Chemistry and Biomolecular Materials program director, shows the Secretary a vial containing a bioinspired self-assembling block polymer. These self-assembled structures can serve as templates for biomineralization.

Ames Laboratory Presents

"Keep 'em Flying!"

A World Year of Physics event especially for kids!

How do planes fly? How do butterflies and other insects fly? How is their flight similar? How is it different? Check out the fun physics of flight and make some "THINGS with WINGS" to take home.

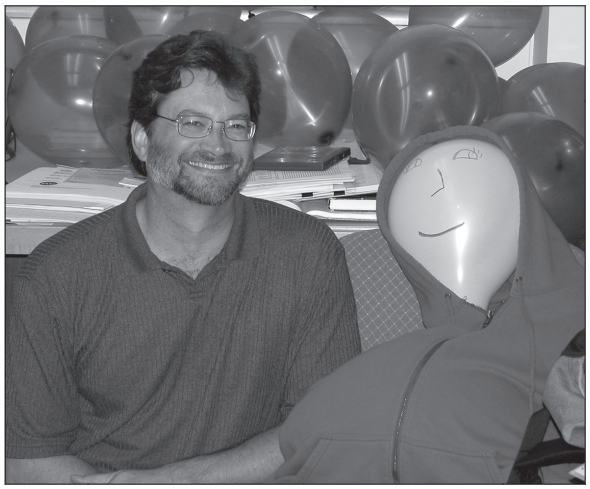
Date: Tuesday, July 12, 2005

Time: 1:30 p.m.

Place: Ames Public Library
515 Douglas Avenue

Presenters:
Donald Lewis, ISU Entomology Department
John Jacobson, ISU Aerospace Engineering Department

Note: This Library event is intended for youngsters in grades 4-6.



Pic of the Month

Marc Porter, associate, celebrates his 50th birthday with an unidentified co-worker. Other group members were burned out after party preparations left them blistered from tying knots in the 300 balloons that flooded Porter's office.

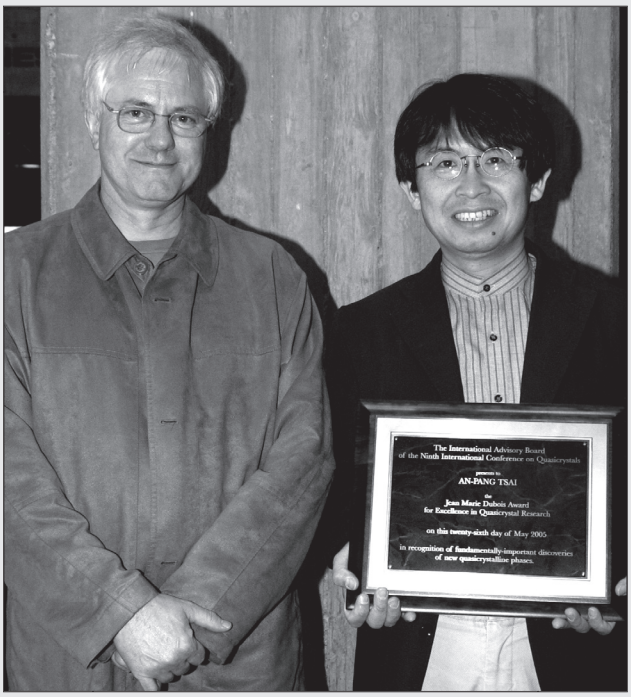
The countdown to Porter's 50th began Dec. 27, 2004, with the construction of a paper chain to mark the days until his June 7 birthday. The chain stretched from secretary Becky Staedtler's office at the west end of ground floor Spedding all the way to the drinking fountain near the east end. No doubt the birthday art experience will link group members to one another for all time!

Tsai Receives DuBois Award at International Quasicrystal Conference

Citing his "fundamentally important discoveries of new quasicrystalline phases," the Advisory Board of the International Conference on Quasicrystals named Professor An-Pang Tsai of Sendai University as the winner of the inaugural Jean-Marie Dubois Award. The award, which consists of a $2,000 cash prize and a plaque, is named after pioneering quasicrystal researcher Professor Jean Marie Dubois of the Ecole des Mines de Nancy as a way to honor his research and his tireless efforts to advance the field.

The Dubois Award will be presented each time the International Conference on Quasicrystals is held, typically every two to three years at various sites around the world. Because the 2005 conference was hosted in May by Ames Laboratory and Iowa State University, the award endowment is being administered by the Iowa State University Foundation.

An-Pang Tsai, formerly with the National Institute for Materials Science in Tsukuba, Japan, was recognized for the work that he embarked upon as a graduate student at Tohoku University in the late 1980's, and which he has continued into the present day. Almost 90 percent of stable quasicrystalline alloys now available are based on Tsai's discoveries. ■



Jean Marie Dubois stands with An-Pang Tsai who received the first-ever Dubois Award for excellence in quasicrystal research.

Student Undergraduate Laboratory Internship Program Begins

10 students from across the country call Ames Lab home for eight weeks

On Monday, June 13, Ames Laboratory opened its doors to 10 special undergraduates. The students, from colleges and universities around the country, are participating in the Lab's Summer Undergraduate Laboratory Internship program, or SULI. The program had been on hiatus for several years because of budget cuts. But due to renewed funding support from the DOE Office of Science, it has been reactivated. SULI is being coordinated by the Public Affairs Office with assistance from director Tom Barton.

Welcome 2005 SULI students!

Student	College/University	Ames Lab/ISU Mentor:
Amanda DeVries (Jr.)	Buena Vista University	George Kraus
James (Shamus) Cronin (Sr.)	Clemson University	Iver Anderson
Brian Langstraat (Fr.)	Central College	Masha Sosokina
Tom Maloney (So.)	Univ. of Cincinnati	Nicola Bowler
Travis Monk (Sr.)	Truman State University	Kai-Ming Ho and Kristen Constant
Eric Poweleit (Jr.)	Univ. of Wisconsin-Madison	Gordon Miller
Xueying (Victor) Qin (Fr.)	Carleton College	Kai-Ming Ho and Kristen Constant
David Sauer (So.)	Univ. of Missouri-Rolla	Bill McCallum
Andrew Shuff (Jr.)	Texas A&M University	Andreja Bakac
Christopher Wong (Jr.)	Northwestern University	Surya Mallapragada

The SULI program will run for eight weeks, from June 13 to August 5. Qualifying for the Ames Lab program was very competitive. The Lab received 60 applications for the 10 spots for which it received DOE funding. The figure is impressive considering the Lab didn't advertise its openings at any colleges or universities. The applicants were carefully reviewed, and the 10 most-qualified students were paired with Ames Lab and ISU mentors, who are having the students work on research projects in their laboratories. The students' research interests run the gamut from chemistry and mechanical engineering to physics and materials science.

The students receive a stipend for the summer internship and are housed in ISU guest apartments. During their internship, they work full time with their mentors. At the end of the internship, the students are required to have completed a research paper or PowerPoint presentation on their research. In addition, each must submit an abstract for placement in the DOE Journal of Undergraduate Research. The students will also give a poster presentation at the Lab prior to the conclusion of the internship program.

In an effort to make their internships as well rounded as possible and also provide a positive introduction to Iowa State University and central Iowa, the students are participating in educational and recreational activities outside the laboratory. For example, they have received a presentation from ISU Vice Provost for Research Jim Bloedel on the importance of getting a Ph.D. Joining the SULI students for this presentation were undergraduate students participating in the National Science Foundation summer internship program being run out of the ISU chemistry department. The SULI students have also visited the Science Center of Iowa in Des Moines and will visit ISU's Virtual Reality Applications Center. For fun, they will be joining Ames Lab/IPRT and ISU personnel at an Iowa Cubs baseball game in July. ■

~ Steve Karsjen

Students Brian Langstraat (standing) and Andrew Shuff check out a display that shows time-lapse construction of the new Science Center of Iowa.

Students (left to right and front to back) are: Amanda DeVries, Tom Maloney, Eric Poweleit, Brian Langstraat, Andrew Shuff, Christopher Wong, Shamus Cronin, David Sauer, Travis Monk and Victor Qin.

The Physics of Baseball

Rosenberg hits a homer with noon talk

Leading off with a clip from a classic "Seinfeld" episode in which George Costanza teaches hitting to baseball players Derek Jeter and Bernie Williams, Eli Rosenberg, slid easily into his entertaining PowerPoint presentation on the Physics of Baseball, June 23 in the Spedding Hall auditorium.

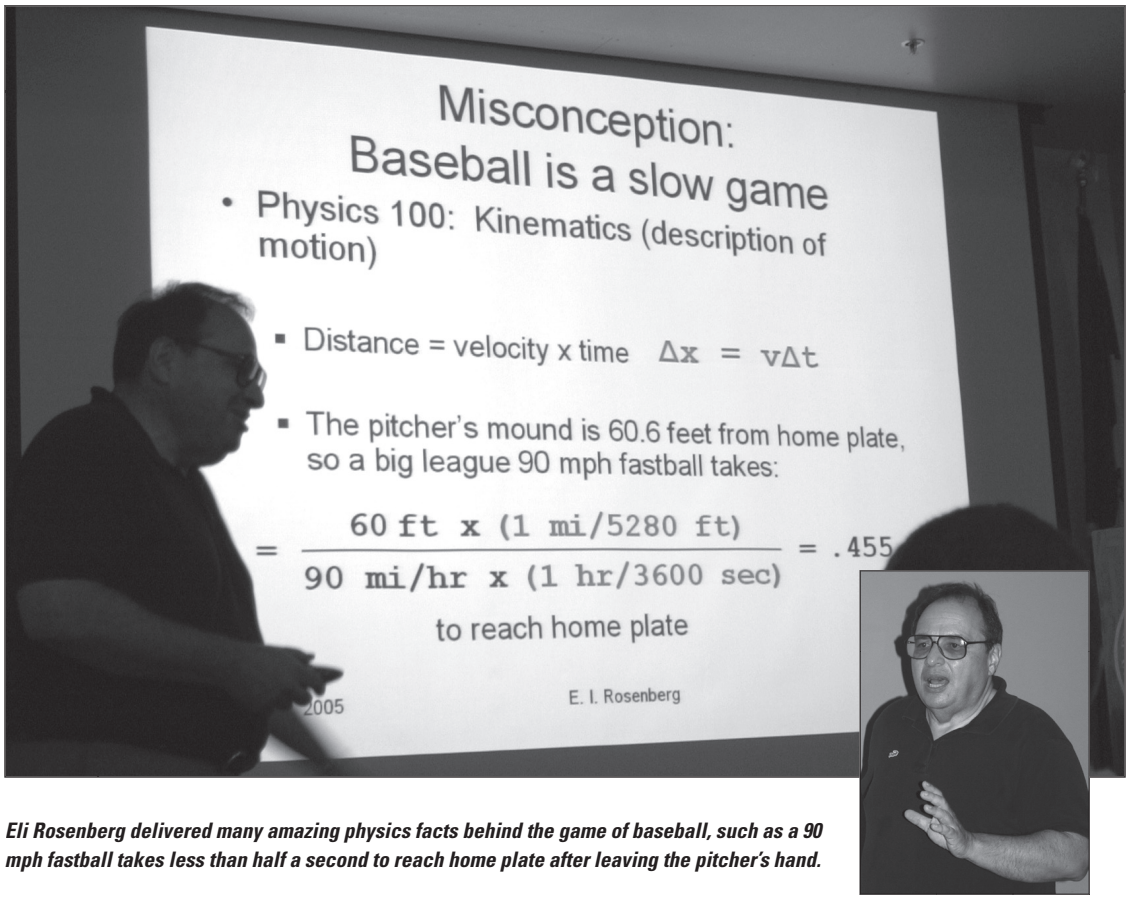
The presentation was the latest in a year-long series of activities coordinated by Ames Lab's Public Affairs Office to help celebrate the 2005 World Year of Physics.

Rosenberg, chair of the Iowa State University physics and astronomy department, played to a full house of baseball and physics enthusiasts, filling them in on the role of physics in America's favorite pastime. The lively presentation was sprinkled with cartoons and famous baseball quotes as well as the more detailed physics of the game – a combination that appealed to everyone and succeeded in keeping the less-physics-oriented audience members on track.

Noting that baseball may not be such a simple game after all, Rosenberg provided some intriguing information on the science of the swing. He explained that the swing itself takes 150 milliseconds. During the first 50 milliseconds, the batter can stop, but after 100 milliseconds, the bat is moving too fast, and the swing cannot be checked. The swing involves moving a two-pound bat at more than 80 miles per hour and delivering up to nine horsepower of energy to the bat. If the swing is seven milliseconds too late or too early, the ball will sail foul past the first- or third-base lines.

Sort of gives you a new outlook on the game, doesn't it! ■

~ Saren Johnston



Eli Rosenberg delivered many amazing physics facts behind the game of baseball, such as a 90 mph fastball takes less than half a second to reach home plate after leaving the pitcher's hand.

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